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GB 2384643 A JP 2002335432 A
US 20030216151 A1

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Other: WPI, EPODOC, JAPIO

(54) Abstract Title: **Mobile telephone terminal with camera and using display to illuminate scene.**

(57) A mobile telephone terminal 1 comprises a display 11 (for example, in addition to a main display 6, Figure 1B), a camera lens 6 and a radiation sensing means 13, all of which may be mounted on the same face 3 of the phone. The display, which may be a liquid crystal display (LCD) or formed from light emitting diodes (LEDs), is activated when the camera is operated so that the display illuminates the object being imaged. Use of the telephone display as an imaging light source may be automatic, in response to the ambient light levels detected by the radiation detector 13. The display screen 11 operates in two modes, emitting lower light intensities for normal, data display and higher light intensities when required to illuminate a view to be captured as an image. The display screen may be formed from organic light emitting diodes (OLED), removing the need for backlighting. Alternatively, as shown in Figure 2, the main display 6 may be used as the illuminating screen, and a retractable viewfinder 25 may be provided.

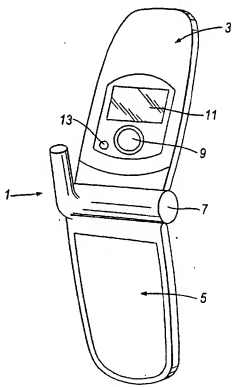

Fig.1A

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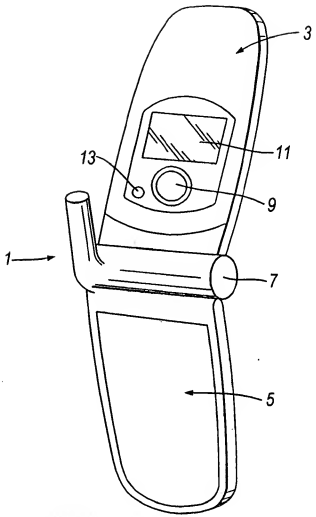

Fig.1A

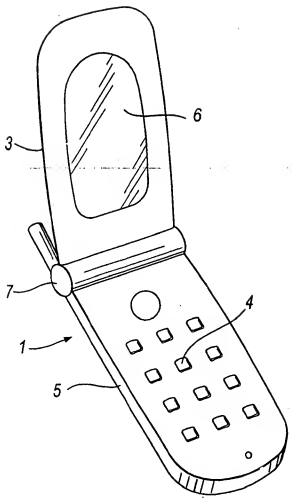

Fig.1B

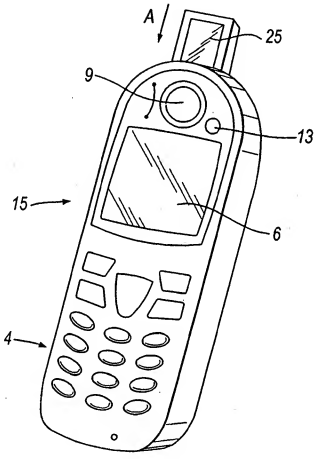

Fig.2

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MOBILE TERMINAL WITH CAMERA

This invention relates to a mobile terminal including a display and a camera.

Many mobile terminals for use with GSM or UMTS (3G) mobile telephone networks incorporate a digital camera. Such a camera allows a user to capture images, to store the captured images on the memory of the mobile terminal, and to transmit these images to third parties. The captured images may be a "still" image (i.e. a single frame, like a conventional photograph) or may be a video clip (i.e. a series of frames captured in quick succession). The captured images may be transmitted in any suitable format – for example in the form of a "picture message" transmitted by multimedia message service (MMS).

The digital cameras typically used in mobile terminals are fairly rudimentary. They typically have a fixed focus, no optical zoom and a fixed exposure setting.

Conventional film and digital cameras are more sophisticated and typically, for example, allow the exposure to be adjusted by adjusting the lens aperture setting and/or the shutter speed. Conventional cameras (including digital cameras) commonly include an additional light source or "flash" that is illuminated while an image is captured in low light conditions. However, the types of light source generally incorporated into conventional film cameras and digital cameras, known as flash modules, are not appropriate for use in mobile telephone terminals due to their size and power consumption. Such flash modules also generally have a "recharging period" of the number of seconds, meaning that several images cannot be captured in quick succession.

A known mobile telephone terminal, the Sharp (RTM) GX-20, comprises a light emitting diode (LED) which may be illuminated when an image is captured by a digital camera built into the mobile terminal in order to illuminate the subject of the captured image and thereby provide improved camera performance in low-light conditions. Although an improvement over flash modules in terms of size and power consumption, the light output from such an LED is generally much lower than the light output from the flash module.

In accordance with a first aspect of the invention, there is provided a mobile telephone terminal including a display for displaying data to the user of the terminal, a camera for capturing an image of a subject, and means for activating the display when the camera is operated to capture an image of a subject such that the subject is illuminated by the display.

In accordance with a second aspect of the invention, there is provided a method of capturing an image of a subject using a mobile telephone terminal including at least one display for displaying data to the user of the terminal, and a camera for capturing an image of the subject, the display or one of the displays being mounted on the same face of the terminal as a lens for the camera, the method including activating the display mounted on the same face of the terminal as the lens for the camera when the camera is operated to capture an image of the subject such that the subject is illuminated by the display.

The requirement for a separate LED to illuminate a subject of its captured image is obviated by the activation of the mobile terminal display when the camera is operated to capture an image. The separate LED of the prior art device increases the cost and complexity of manufacture of the mobile terminal because an additional component (the LED) must be provided, together with appropriate

electrical connectors, power supplies and control electronics. Further, the LED may adversely affect the appearance of the mobile terminal.

Embodiments of mobile telephone terminals and a method of capturing an image in accordance with the invention will now be described by way of example only with reference to the accompanying diagrammatic drawings in which:

Figures 1A and 1B are perspective views of a mobile telephone terminal in accordance with a first embodiment of the invention; and

Figure 2 is a perspective view of a mobile telephone terminal in accordance with a second embodiment of the invention.

In the drawings like elements are generally designated with the same reference numeral.

Many mobile telephone terminals have a display on the same surface of the terminal as the lens for the camera. This display is normally used to display, for example, status information, caller ID and in some cases can be used as a viewfinder by displaying the image captured by the camera lens 11 to allow the user to compose photographs of him or herself. This display is often backlit to allow the user to see the information displayed in low light conditions. In one embodiment the present invention uses the backlight of this display as a light source for the camera to provide illumination of the subject, enabling photographs to be taken in low light conditions. This avoids the extra manufacturing step of incorporating a separate LED into mobile telephone terminals to be used as the light source. A further advantage is provided if the display comprises organic LEDs (OLEDs) which provide a greater light output than conventional LEDs (used as a light source in the prior art), thereby

providing greater illumination of the subject and increasing the functionality of the display when used as a light source.

An OLED is an electronic device made by placing a series of organic thin films between two conductors. When electrical current is applied, a bright light is emitted. This process is called electro-phosphorescence. Even with the layered system, the devices are very thin, usually less than 500 nanometres.

When used to produce displays, OLED technology produces self-luminous displays that do not require backlighting. This allows the production of thin, very compact displays. Such displays also have the advantage of a wide viewing angle – up to 160° – and require very little power, typically 2-10 volts.

OLED displays have other advantages over LCDs. For example, they offer increased brightness, fast response time (advantageous to display video clips), lighter weight, greater durability and broader operating temperature ranges.

There are two types of OLED displays – passive and active.

Passive OLED is the simplest form. An anode and a cathode are provided to drive the light emitting material by recombination. Rows and columns of conductive lines are provided to provide a matrix of emitter elements. The individual elements have the electrical characteristics of a capacitor. Thus, to drive the emitter element it must be supplied with current and not voltage. Despite the simplicity of passive OLED, a disadvantage is that it requires a fairly high current to maintain the display brightness.

Active OLED devices have a switching thin film transistor (TFT) and storage capacitor next to each emitting pixel. This lowers the peak drive currents and

allows the pixel to stay illuminated for much longer. The TFT structure currently preferred is low temperature polysilicone (LTPS). Thus, active matrix OLED technology shows many common elements with the technology LTPS AMTFT LCD. An advantage of LTPS active OLED displays is that the manufacturing cost is lower than a comparable TFT LCD using LTPS. The lower manufacturing costs are due partly because an active OLED does not require colour filters, polarisers, alignment material, backlighting or expensive glass.

Figures 1A and 1B show a perspective view of a mobile telephone terminal 1 in accordance with a first embodiment of the invention. This terminal is of the "flip" design, comprising a first portion 3 and a second portion 5 joined by a hinge assembly 7. The terminal 1 is shown in the open position, thereby allowing a user to access the keypad 4 and main display 6 provided on inner faces of the terminal. When not in use the terminal 1 can be closed, with the inner faces of the first portion 3 and the second portion 5 being brought into parallel contact.

The camera function of the terminal 1 is provided by elements located on the outer face of the first portion 3, comprising a camera lens 9, a display 11 and radiation detecting means 13. The display 11 is used to display status information and caller ID, advantageously when the terminal 1 is closed, and can also act as a view finder by displaying the image captured by the camera lens 11 to allow the user to compose photographs of him or herself.

The camera may be activated by the user in known fashion – by operating a button on the keypad 4. The radiation detecting means 13 then detects the ambient light level, and a light source may be activated in low light levels to illuminate the subject while the photograph is taken. In this embodiment the

light source is provided by the back light of the display 11. For example, the display may be a liquid crystal display (LCD). Conventionally, such LCD displays include a backlight that emits white light and allows the LCD display to be viewed in low light conditions (where the LCD display would otherwise be invisible). In accordance with one aspect of the invention, the same light source as is provided for backlighting the display 11 is also used to illuminate the subject of the captured image. Optionally, the backlight is operated at a different intensity when illuminating the display 11 for viewing in low light conditions and for illuminating the subject when the image of the subject is captured. If such an arrangement is provided, a higher level of illumination will be provided when the backlight is activated to illuminate the subject of the image being captured. The display 11 is preferentially located near to the camera lens 9.

When the user of mobile telephone terminal 1 wishes to capture an image of a subject, the user will direct the camera lens 9 towards that subject. Either the main display 6 or the secondary display 11 may act as a view finder by displaying the image captured by the camera lens 11 and thereby allowing the user to compose the image to be captured. Typically, the secondary display 11 will be used as a view finder if the user wishes to capture an image of him or herself, and, otherwise, the main display 6 will be used. When the user is satisfied with the composition of the image as displayed in the main display 6 or secondary display 11, the user operates the keypad 4 of the mobile telephone terminal 1 to instruct the mobile telephone terminal 1 to operate the camera so that the image captured by the camera lens 9 is recorded electrically and stored (typically digitally) in a memory store provided in the mobile telephone terminal 1. The captured image may be a single frame or multiple frames (video capture). The user may subsequently view the captured images using the main display 6 or the secondary display 11. The facility may also be provided by the mobile

telephone terminal 1 to allow the captured image to be transmitted to a third party, for example by generating and transmitting a MMS message.

As an alternative to the secondary display 11 comprising an LCD display having a backlight, the display 11 may comprise light emitting diodes. Advantageously, the display 11 is an organic LED (OLED) display, which provides greater light output than conventional LEDs. Alternatively, the display 11 may be an electroluminescent display. Whichever type of display is used, the illumination level is preferably higher when the display is used as a flash, then when the display is to be viewed in low light conditions.

The mobile telephone terminal 1 includes a control module responsive to actuation of an appropriate key on the keypad 4 operated by the user to capture an image. When the appropriate key is actuated by the user, the radiation detecting means 13 is operated to detect the level of ambient light. The detecting means 13 generates an electrical signal proportional to the level of ambient light, and this is received and analysed by the control module. If the control module determines that the ambient light level is below a predetermined threshold, the control module activates the display 11 (or the backlight of the display 11) to cause the subject of the image to be captured to be illuminated, thereby improving the quality of the captured image of the subject. The signal from the detecting means may be used to control the intensity of the display illumination – to cause an appropriate level of illumination in dependence upon the level of ambient light. Preferably, the display 11 (or backlight of the display 11) is illuminated for a period of time approximately equal to the period of time during which the camera is operative to capture an image using the camera lens 9.

In an alternative arrangement, the display 11 (or backlight of the display 11) is automatically activated whenever an image is captured by the camera using the

camera lens 9. In such an arrangement the radiation detecting means 13 may be dispensed with, and the control module may be simplified so that the control module automatically activates the display 11 (or backlight thereof) every time the camera is activated to capture an image. In yet another alternative arrangement, the user may manually select the secondary display 11 (or backlight thereof) to activate when it is desired to capture an image of a subject using the camera lens 9.

A second embodiment of the invention is shown in Figure 2. The mobile terminal 15 includes a camera lens 9 of a camera, a display 6 and radiation detecting means 23. In this embodiment, the display 6 is the main display of the terminal 15 and thus provides the main interface between the user and the terminal 15 to allow the user to operate the terminal. The display 6 is located on the same face of the terminal as the keypad 4 and the camera lens 19. In this embodiment, the sole display of the terminal is located on the same face as the camera lens 9. The display 6 is therefore unable to be used as a viewfinder for the camera (except for when the user wishes to take a photograph of him or herself). A retractable optical view finder 25 is provided which allows the user to compose an image of the subject to be photographed. This view finder 25 may retract into the body of the terminal as shown by arrow A. The view finder may include an optical lens.

The radiation detecting means 13 detects the ambient light level, and the display 6 light source may be automatically activated in low light levels to illuminate the subject while the image is captured. If required, the light source is provided by the backlight of the display 6, which is used to display white light at full illumination thereby acting as a light source to illuminate the subject while the image is captured. In this embodiment the display 6 is preferentially located near to the camera lens 9.

The present invention is also applicable to mobile telephone terminals that comprise more than one camera lens 9. For example, two camera lenses could be provided – one provided to capture an image facing a first side of the mobile telephone terminal, and the second provided for a captured image facing a second, opposite side of the mobile terminal. A separate camera (that is, including image capturing and recording means) may be provided associated with each lens, or both lenses may be coupled to the same camera. A display in accordance with the invention may be provided in association with both or either of the camera lenses to improve the quality of the image captured by the or each lens in low light conditions.

The present invention is also applicable to a mobile telephone terminal where the camera lens is movable with respect to the housing. For example, the camera lens may be mounted to move pivotally with respect to the main body of the mobile telephone terminal. One or more than one display in accordance with the invention may be activated when it is desired to capture an image using the camera lens in order to illuminate the subject of the captured image. A sensor may be provided in the mobile telephone terminal to detect the position of the camera lens and to activate one or more display in accordance with the invention to provide the best or most appropriate illumination of the subject in accordance with the measured circumstances.

The display may be moveable with respect to the mobile terminal body and/or camera lens, thereby allowing the user to direct the display to provide the most effective illumination of the subject.

It will be appreciated by one skilled in the art that there are various mobile terminal embodiments to which the invention could be applied, and the

embodiments described herein are not intended to, and should not be taken to, limit the scope of the invention.

CLAIMS

1. A mobile telephone terminal including a display for displaying data to the user of the terminal, a camera for capturing an image of a subject, and means for activating the display when the camera is operated to capture an image of the subject such that the subject is illuminated by the display.

2. The terminal of claim 1, including means for controlling the activation means for automatically activating the display when the camera is operated.

3. The terminal of claim 2, wherein the controlling means is operable to cause the display to activate simultaneously or contemporaneously with operation of the camera to capture an image.

4. The terminal of claim 2 or 3, wherein the activating means includes a radiation detector for detecting ambient light levels and is selectively operable to activate the display in dependence on the ambient light levels.

5. The terminal of claim 1, 2, 3, or 4, wherein the display includes a backlight and said activation of the display includes activation of the backlight.

6. The terminal of any one of the proceeding claims, wherein the display is a liquid crystal display.

7. The terminal of any of claims 1 to 5, wherein the display is a light emitting diode display.

8. The terminal of claim 7, wherein the display is an organic light emitting diode display.

9. The terminal of any one of the proceeding claims, wherein the display is mounted on the same face of the terminal as a lens for the camera.

10. The terminal of any one of the proceeding claims, wherein the display is the sole display of the terminal.

11. The terminal of any one of the proceeding claims, including a viewfinder.

12. The terminal of claim 11 wherein the viewfinder is retractable.

13. The terminal of any one of claims 1 to 9, including one or more further displays.

14. The terminal of claim 13, wherein the further display or one of the further displays is located on a different surface of the terminal to the said display.

15. The terminal or claim 13 or 14, including means for displaying the image captured by the camera on said further display.

16. The terminal of any one of the preceding claims, wherein the display and the actuation means are operable to activate the display to generate a higher illumination intensity when the camera is operated to capture an image, and to activate the display to generate a lower illumination intensity when the display is otherwise activated.

17. A method of capturing an image of a subject using a mobile telephone terminal including at least one display for displaying data to the user of the terminal, and a camera for capturing an image of a subject, the display or one of

the displays being mounted on the same face of the terminal as a lens for the camera, the method comprising the steps of:

operating the camera to capture an image of the subject, and

activating the display mounted on the same face of the terminal as the lens for the camera when the camera is operated to capture an image of the subject such that the subject is illuminated by the display.

18. A method according to claim 17, wherein the display is automatically activated when the camera is operated.

19. A method according to claim 18, wherein the display is activated simultaneously or contemporaneously with operation of the camera to capture an image.

20. A method according to claim 18 or 19, further comprising the steps of:

detecting the ambient light levels, and

selectively activating the display in dependence on the ambient light levels.

21. A mobile telephone terminal, substantially as described herein and/or with reference to Figure 1 or Figure 2 of the accompanying drawings.

22. A method substantially as hereinbefore described with reference to the accompanying drawings.

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Application No:	GB0403026.8	**Examiner:**	Matthew Males
Claims searched:	1, 17	**Date of search:**	23 July 2004

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular reference
X	1 - 3, 5, 6, 9, 10, 17 - 19 at least	JP2002335432 A MATSUSHITA - see WPI abstract accession no. 2003-271135 and associated PAJ abstract; Fig 1.
X	1 - 3, 7, 9, 17 - 19 at least	US 2003/0216151 A1 KITANO, NAKAMURA - abstract; pg 2, para [0035] etc.
X	1, 17 at least	GB2384643 A NEC - see abstract: when in a mirrored state, the display also reflects light toward a scene, eg to the eyes of a person who is photographing him/herself.

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC[W] :

H4F

Worldwide search of patent documents classified in the following areas of the IPC[07]

G03B; H04M; H04N

The following online and other databases have been used in the preparation of this search report

WPI, EPODOC, JAPIO